

WHAT IS CLAIMED IS:

1. A control apparatus for an internal combustion engine, the control apparatus comprising:

a control system for controlling the internal combustion engine;

an aging detecting unit for calculating an aging degree of the control system; and

a control gain changing unit for changing a control gain of the control system in accordance with the aging degree.

2. A control apparatus according to claim 1, wherein

the control system includes:

a fuel injector for injecting fuel to the internal combustion engine; and

an air/fuel ratio detecting unit provided in a downstream of the fuel injector with respect to an air intake flow for detecting air/fuel ratio of exhaust gas, and

the control system is an air/fuel ratio control system which controls a fuel injection amount of the fuel injector in accordance with a simulated control object defined from the injector to the air/fuel ratio detecting unit, so that the air/fuel ratio detected by the air/fuel ratio detecting unit coincides with a target air/fuel ratio;

the aging detecting unit calculates an error of the simulated control object as a parameter representing an aging

degree of the air/fuel ratio control system, such that the error of the air/fuel ratio model arises by aging of the air/fuel ratio control system; and

the control gain changing unit changes the control gain of the air/fuel ratio control system in accordance with the error of the simulated control object.

3. A control apparatus according to claim 2, wherein the aging detecting unit calculates the error of the simulated control object in accordance with at least a response of the air/fuel ratio detecting unit.

4. A control apparatus according to claim 1, wherein

the control system includes:

a fuel injector for injecting fuel to the internal combustion engine; and

an air/fuel ratio detecting unit provided in a downstream of the fuel injector with respect to an air intake flow for detecting air/fuel ratio of exhaust gas, and

the control system is an air/fuel ratio control system which controls a fuel injection amount of the fuel injector, so that air/fuel ratio detected by the air/fuel ratio detecting unit coincides with a target air/fuel ratio;

the aging detecting unit calculates a response of the air/fuel ratio detecting unit as a parameter representing an

aging degree of the air/fuel ratio control system; and

the control gain changing unit changes a control gain of the air/fuel ratio control system in accordance with the response of the air/fuel ratio detecting unit.

5. A control apparatus according to claim 1, wherein

the control system further includes:

a rotation speed detecting unit provided in the internal combustion engine for detecting rotation speed of the internal combustion engine; and

a control valve for controlling an air intake amount introduced to the internal combustion engine, and

the control system is an idle rotation control system which controls an opening degree of the control valve, so that the rotation speed detected by the rotation speed detecting unit coincides with a target idle rotation speed;

the aging detecting unit calculates a change of the rotation speed when an electrical load is turned on, for using the change as a parameter representing an aging degree of the idle rotation speed control system;

the control gain changing unit changes a control gain of the idle rotation speed control system in accordance with the change of the rotation speed when the electrical load is turned on.

6. A control apparatus according to claim 1,
wherein

the control gain changing unit decreases the control gain as the aging degree increases.

7. A control apparatus according to claim 1,
wherein

the control system includes:

a rotation speed detecting unit provided in the internal combustion engine for detecting rotation speed of the internal combustion engine; and

a control valve for controlling an air intake amount introduced to the internal combustion engine, and

the control system is a dashpot control system which controls an opening degree of the control valve at an opening degree larger than an opening degree in idling, when operation is changed from non-idling to idling;

the aging detecting unit calculates a change of the rotation speed when an electrical load is turned on, for using the change as a parameter representing an aging degree of the dashpot control system;

the control gain changing unit changes a control gain of the dashpot control system in accordance with the change of the rotation speed when an electrical load is turned on.

8. A control apparatus according to claim 7,
wherein

the control gain changing unit increases the control gain as the aging degree increases.